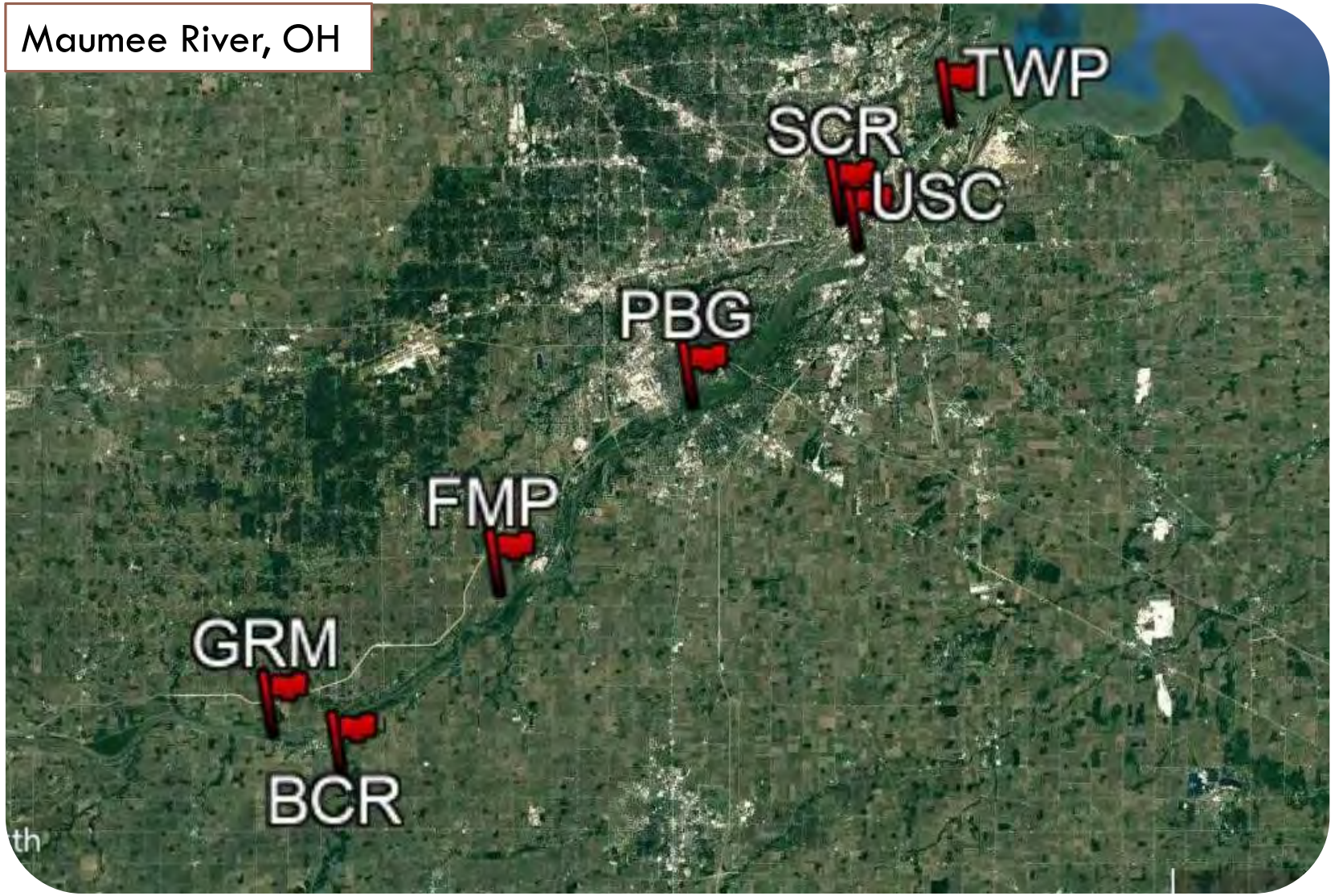
Surface water collected at the Great Lake tributaries slightly activates nuclear hormone receptors of various species

SATOMI KOHNO, HEIKO L. SCHOENFUSS

SAINT CLOUD STATE UNIVERSITY AQUATIC TOXICOLOGY LABORATORY, SAINT CLOUD, MN

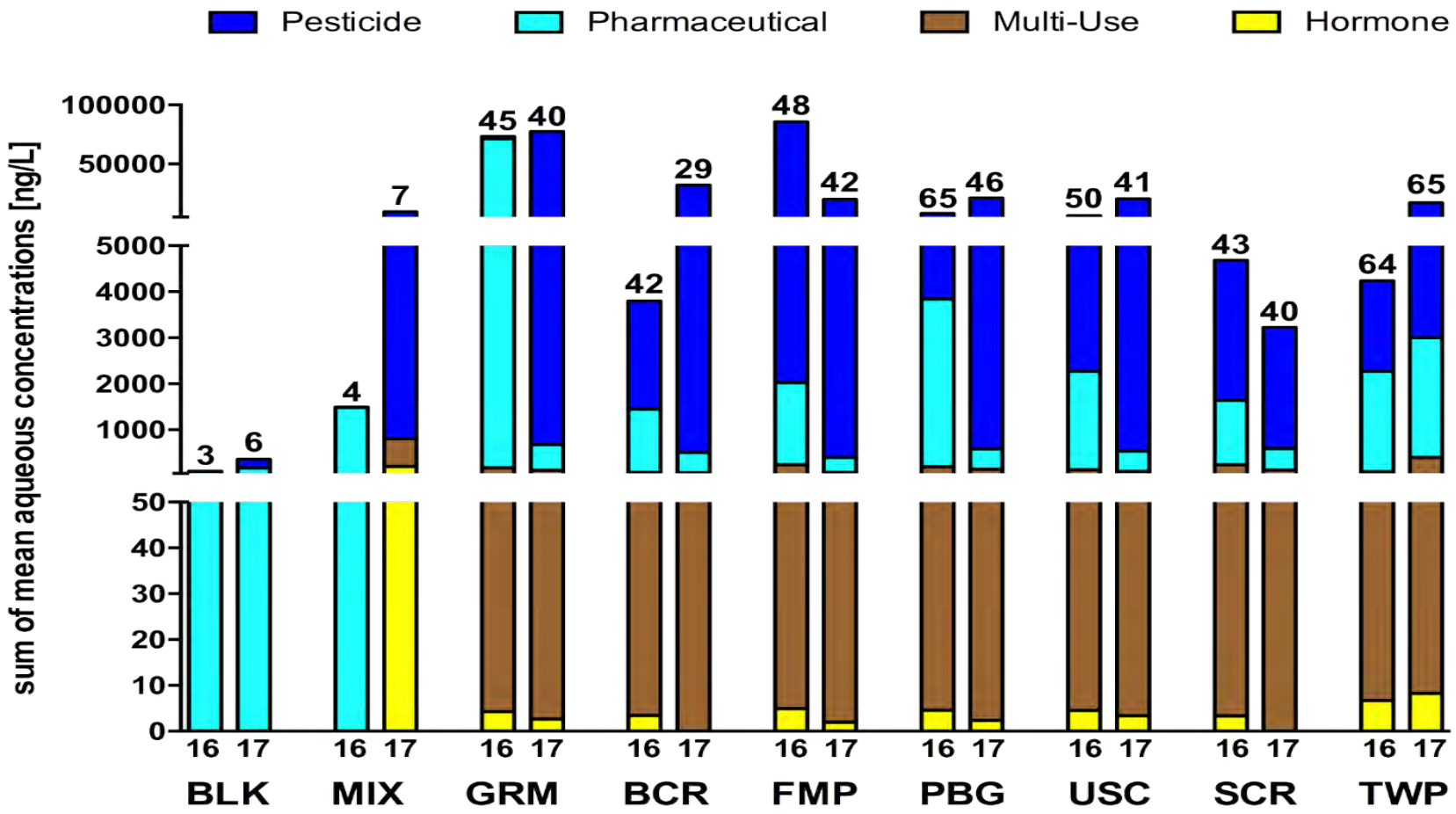
Mobile Exposure Laboratory Trailer (MELT).

Sites of MELT at Maumee River in 2016 & 2017



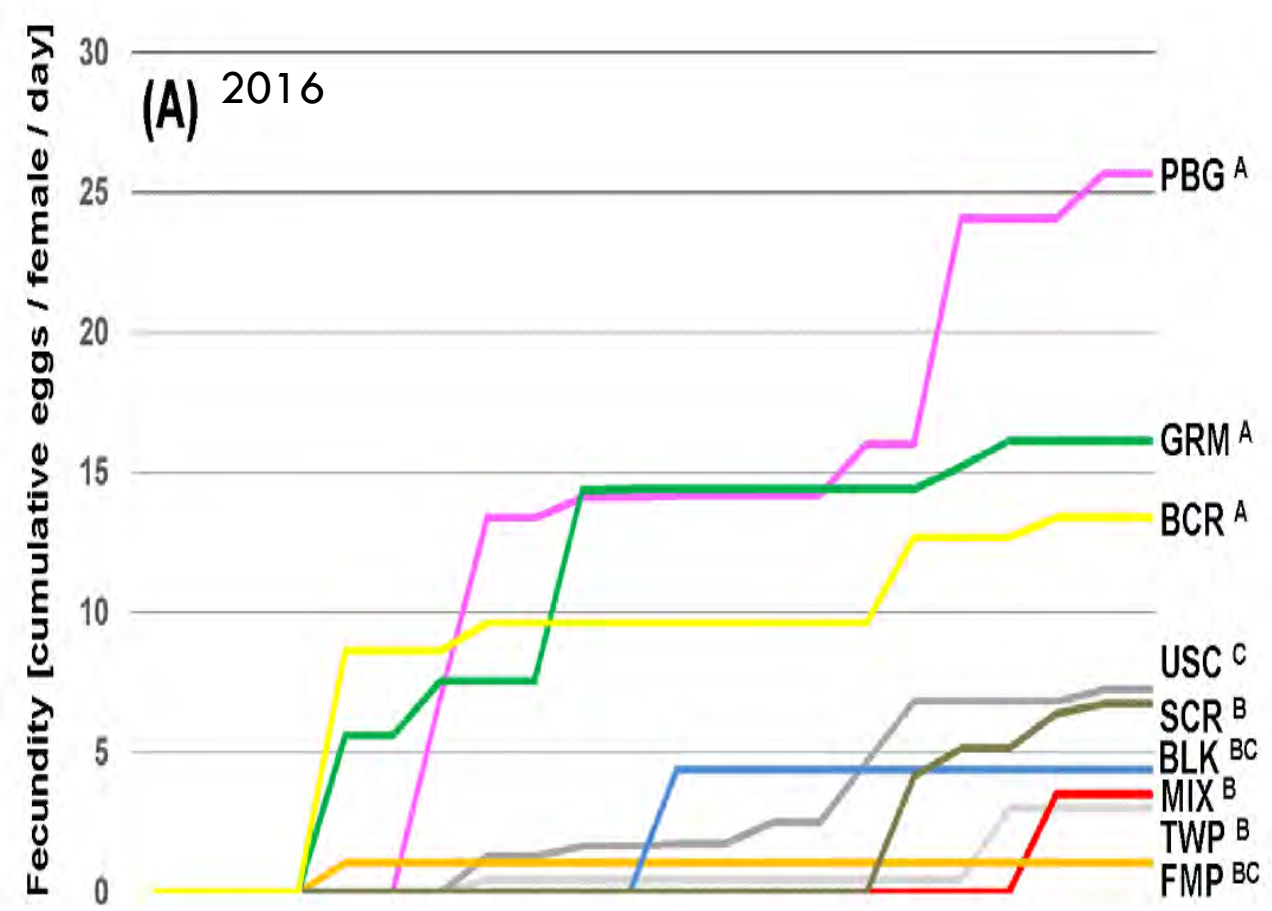
Field sites for water sample collection during the study of the Maumee River watershed in Toledo, Ohio, which flows into Lake Erie. Upstream → downstream site: GRM → TWP.

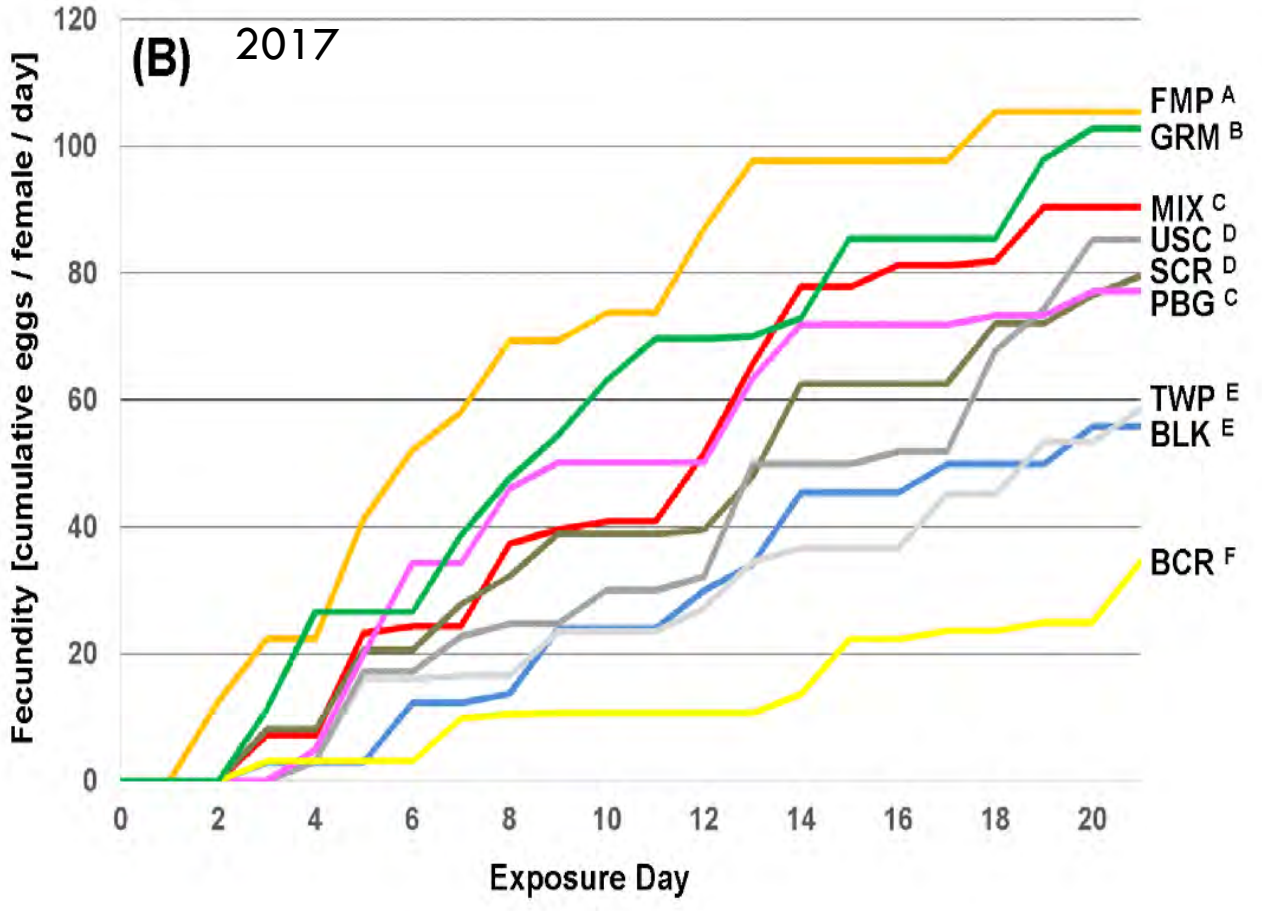
Ubiquitous contaminations with CECs at Maumee River in 2016 & 2017



Chemical classes of aquatic pollutants identified by analytical water chemistry in the Maumee River watershed during the 2016 and 2017 exposures at Mobile Exposure Laboratory Trailer (MELT).

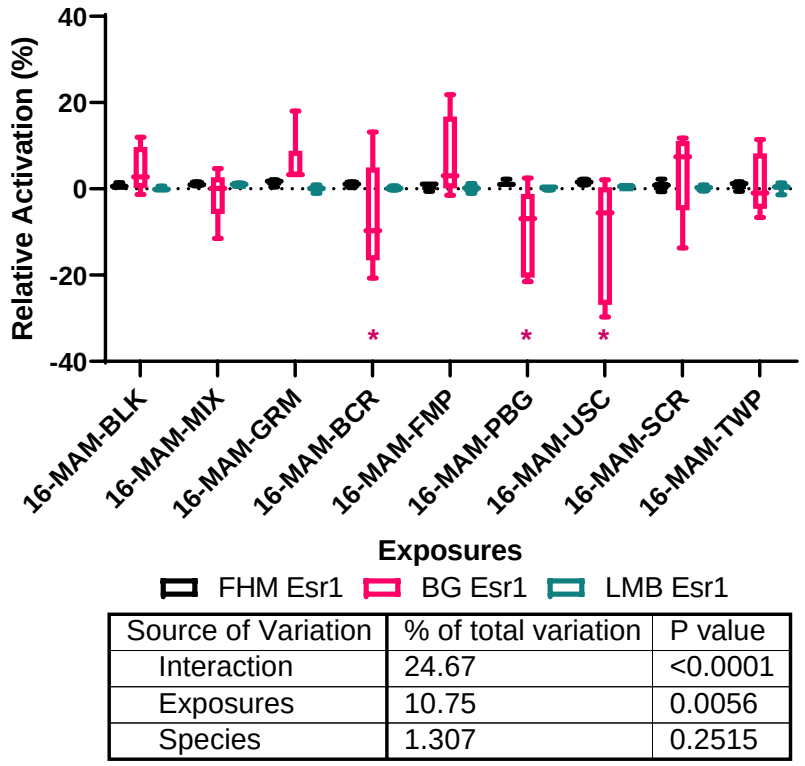
Altered fecundity of fathead minnow in MELT exposure at Maumee in 2016 & 2017





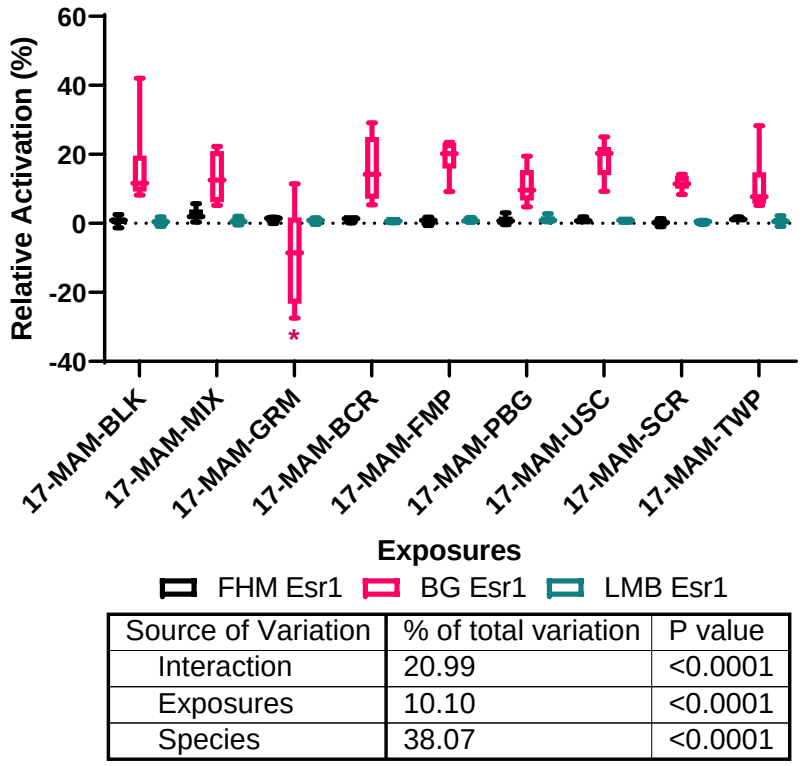
In vitro estrogenicity of MELT water via 3 species Esr1

MAUMEE 2016



Source of Variation	% of total variation	P value
Interaction	24.67	<0.0001
Exposures	10.75	0.0056
Species	1.307	0.2515

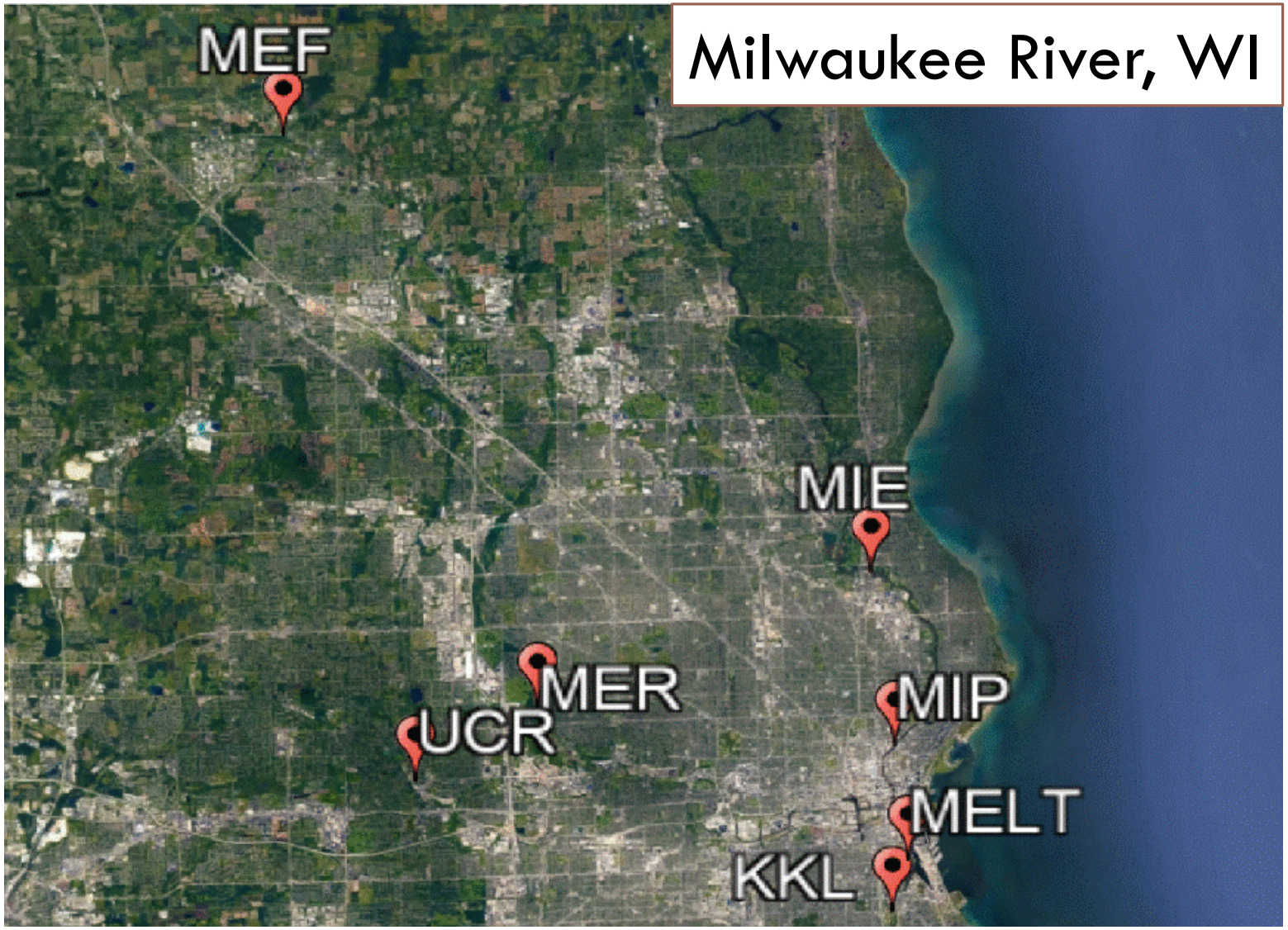
MAUMEE 2017



Source of Variation	% of total variation	P value
Interaction	20.99	<0.0001
Exposures	10.10	<0.0001
Species	38.07	<0.0001

AQUATIC TOXICOLOGY LABORATORY

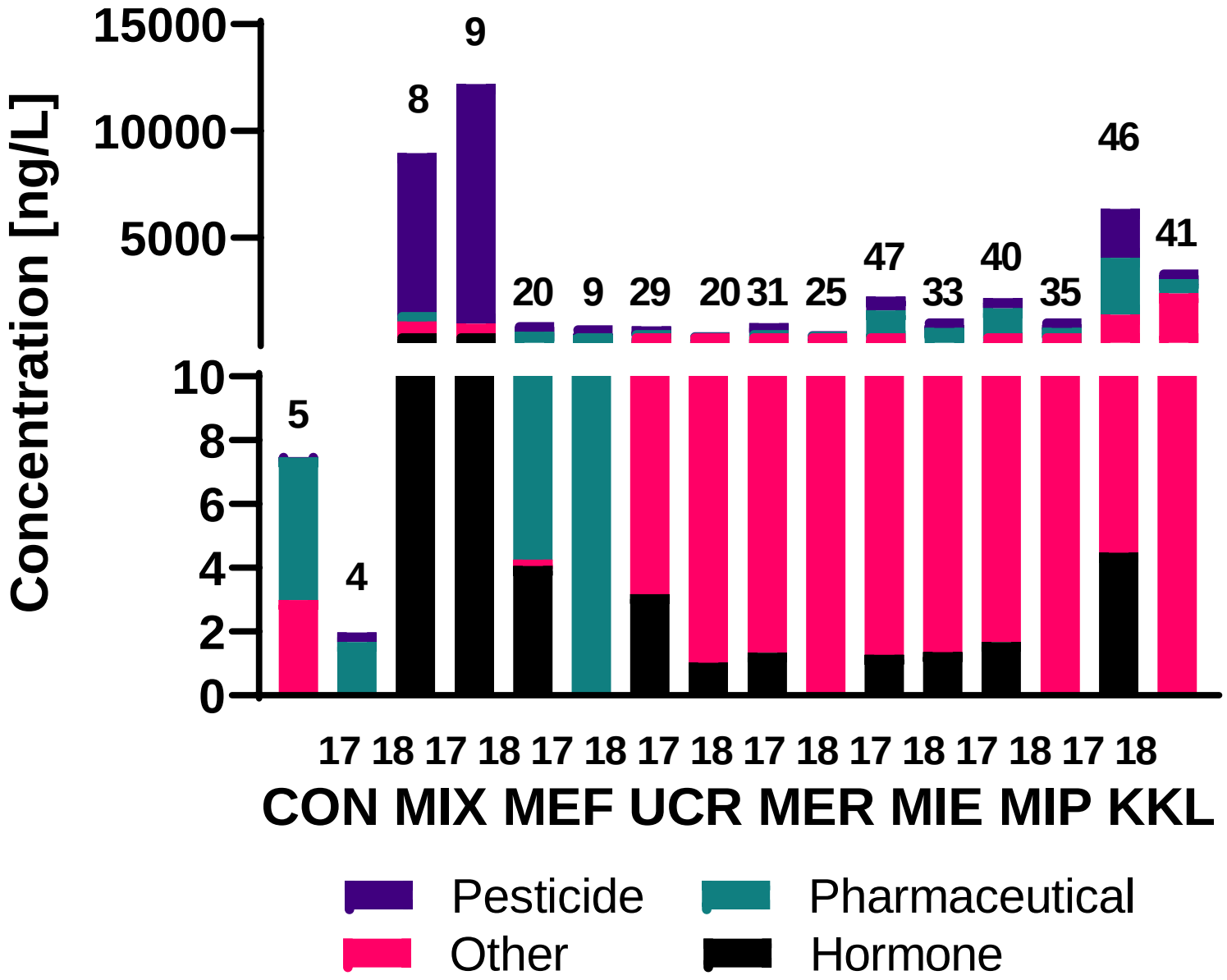
Sites of MELT at Milwaukee in 2017 & 2018



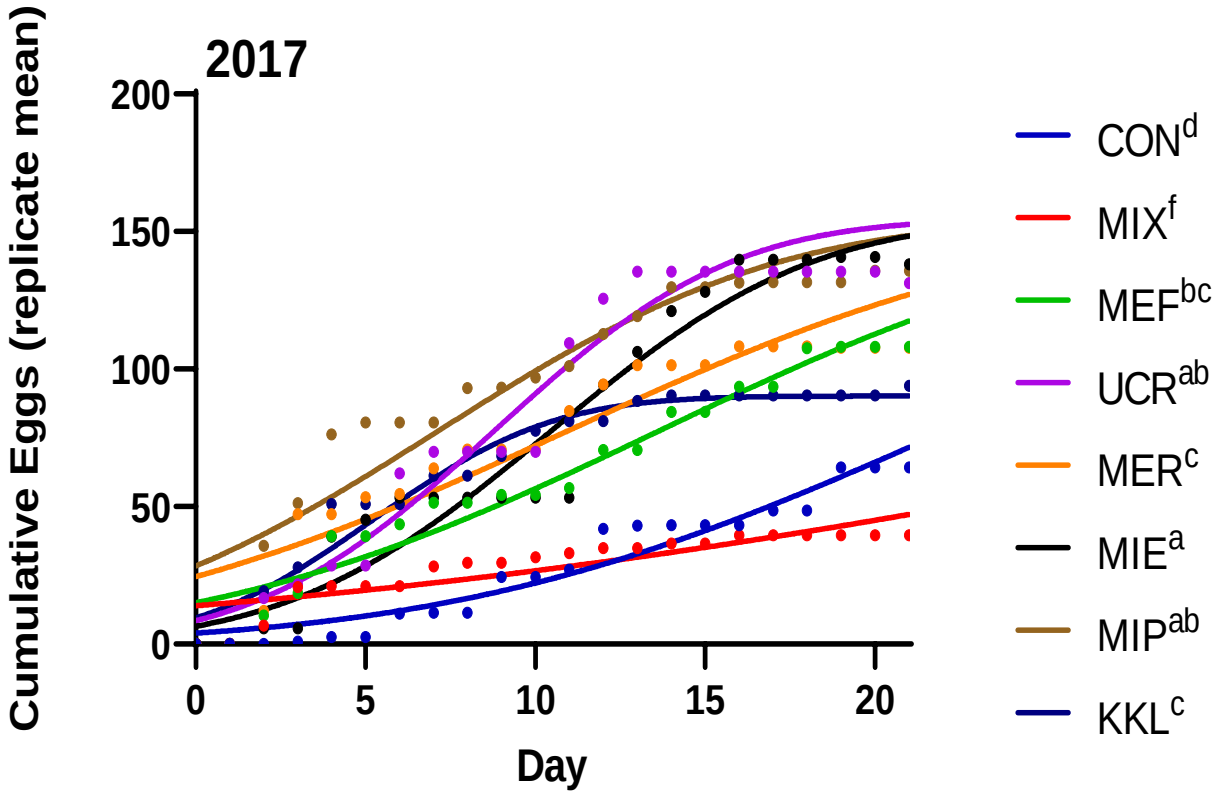
Field sites for water sample collection during the study of the Milwaukee River system watershed in Milwaukee, Wisconsin, which flows into Lake Michigan.. From downstream most site → upstream most site: MEF → KKL.

ST. CLOUD STATE UNIVERSITY

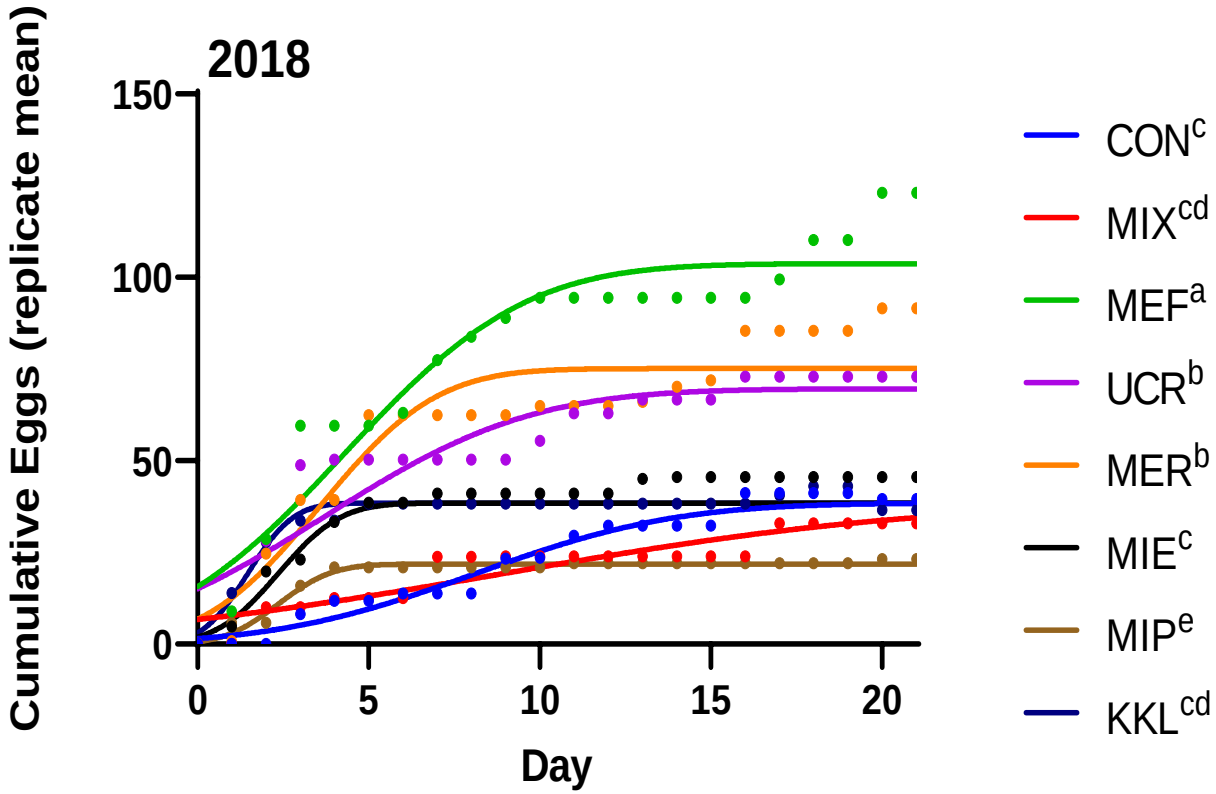
Ubiquitous contaminations with CECs at Milwaukee in 2017 & 2018



Altered fecundity of fathead minnow in MELT exposure at Milwaukee in 2017 & 2018



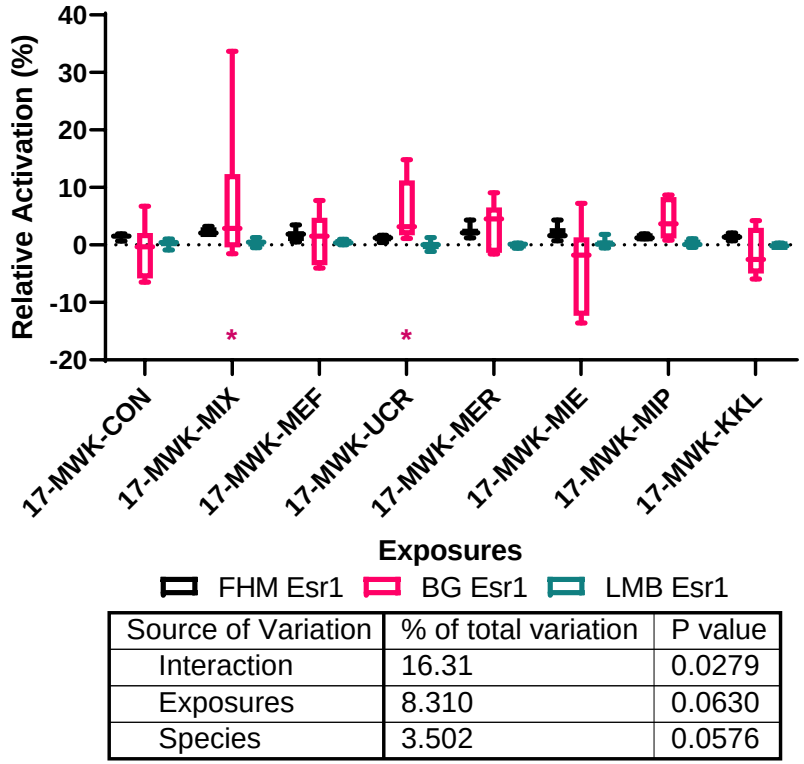
MIE ≧UCR = MIP ≧MEF ≧MER = KKL > CON > MIX



MEF > MER = UCR > MIE = CON ≧KKL = MIX > MIP

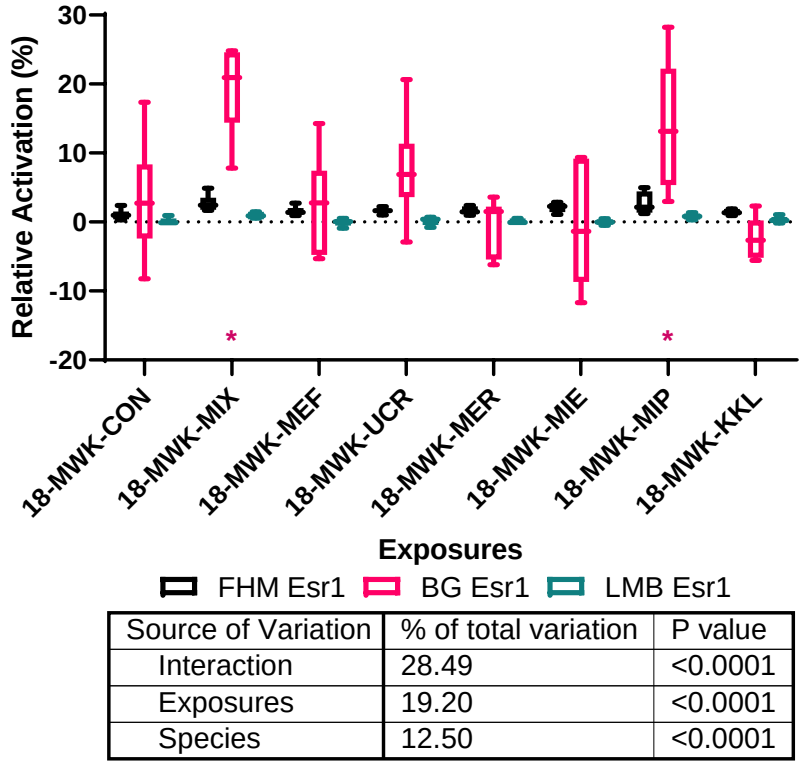
In vitro estrogenicity of MELT water via 3 species Esr1

MILWAUKEE 2017



Source of Variation	% of total variation	P value
Interaction	16.31	0.0279
Exposures	8.310	0.0630
Species	3.502	0.0576

MILWAUKEE 2018



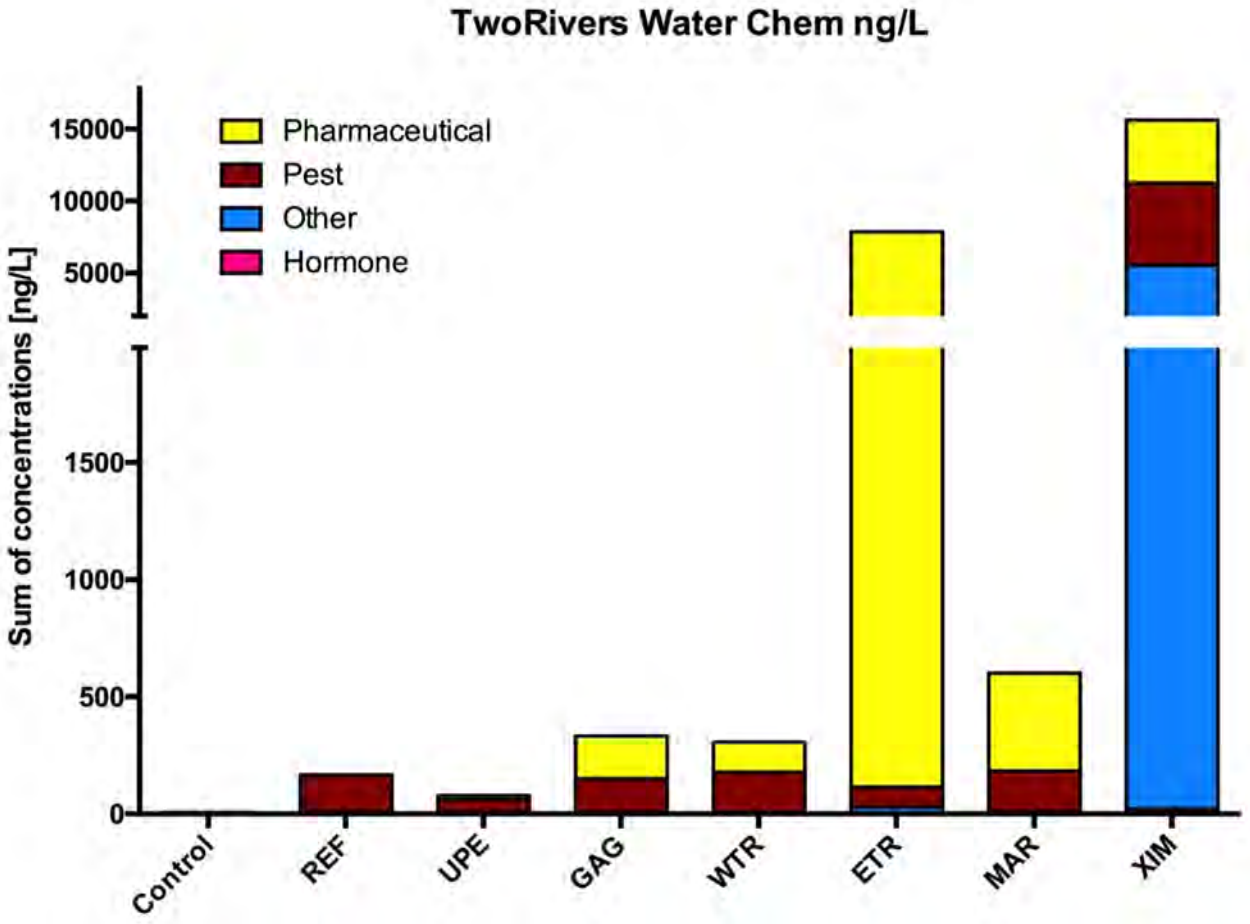
Source of Variation	% of total variation	P value
Interaction	28.49	<0.0001
Exposures	19.20	<0.0001
Species	12.50	<0.0001

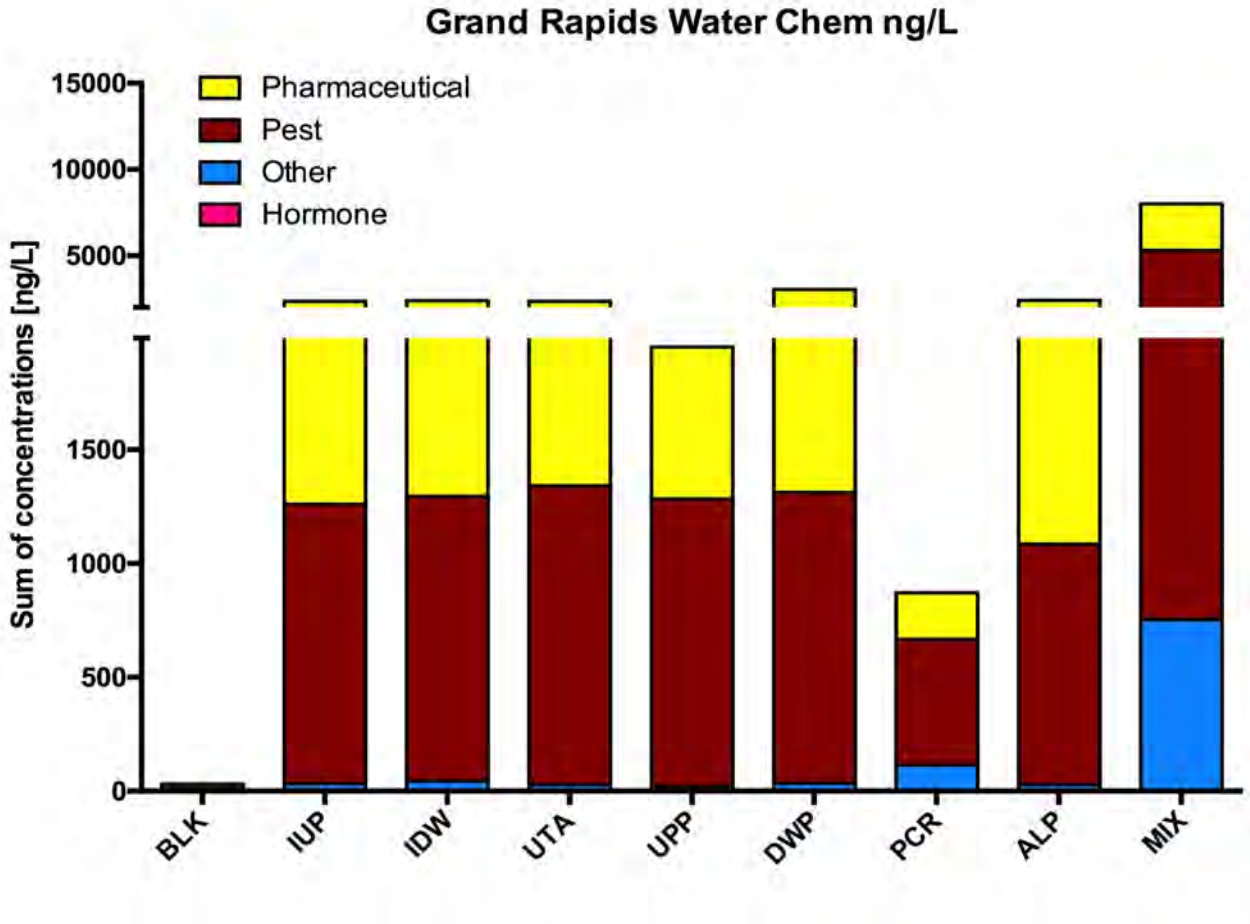
Sites of MELT at Two Rivers & Grand Rapids in 2019

Field sites for water sample collection during the study of the Two Rivers system watershed in Wisconsin, which flows into Lake Michigan. REF, W Twin River Upstream; UPE, East Twin River; GAG, W Twin Kingsbridge; WTR, W Twin below Shoto; ETR, E Twin Maplewood Road; MAR, Confluence of E and W River @ Seagull Marina.

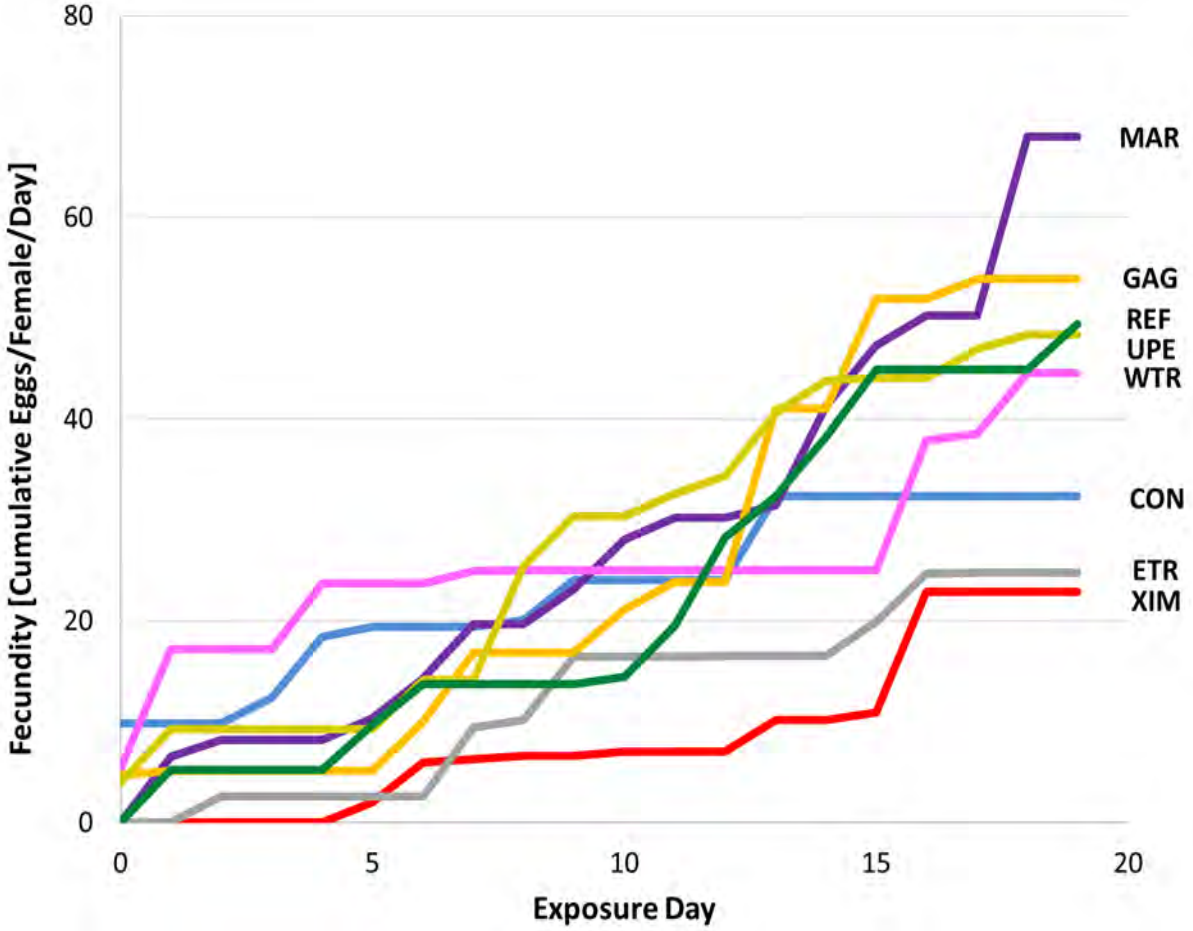
Field sites for water sample collection during the study of the Grand Rapids Rivers system watershed in Michigan, which flows into Lake Michigan. IUP, Ionia upstream; IDW, Ionia downstream; UTA, Upstream of Thornapple Creek; UPP, Upstream Grand Rapids WWTP; DWP, Downstream Grand Rapids WWTP; PCR, Plaster Creek; ALP, Downstream of Allendale WWTP.

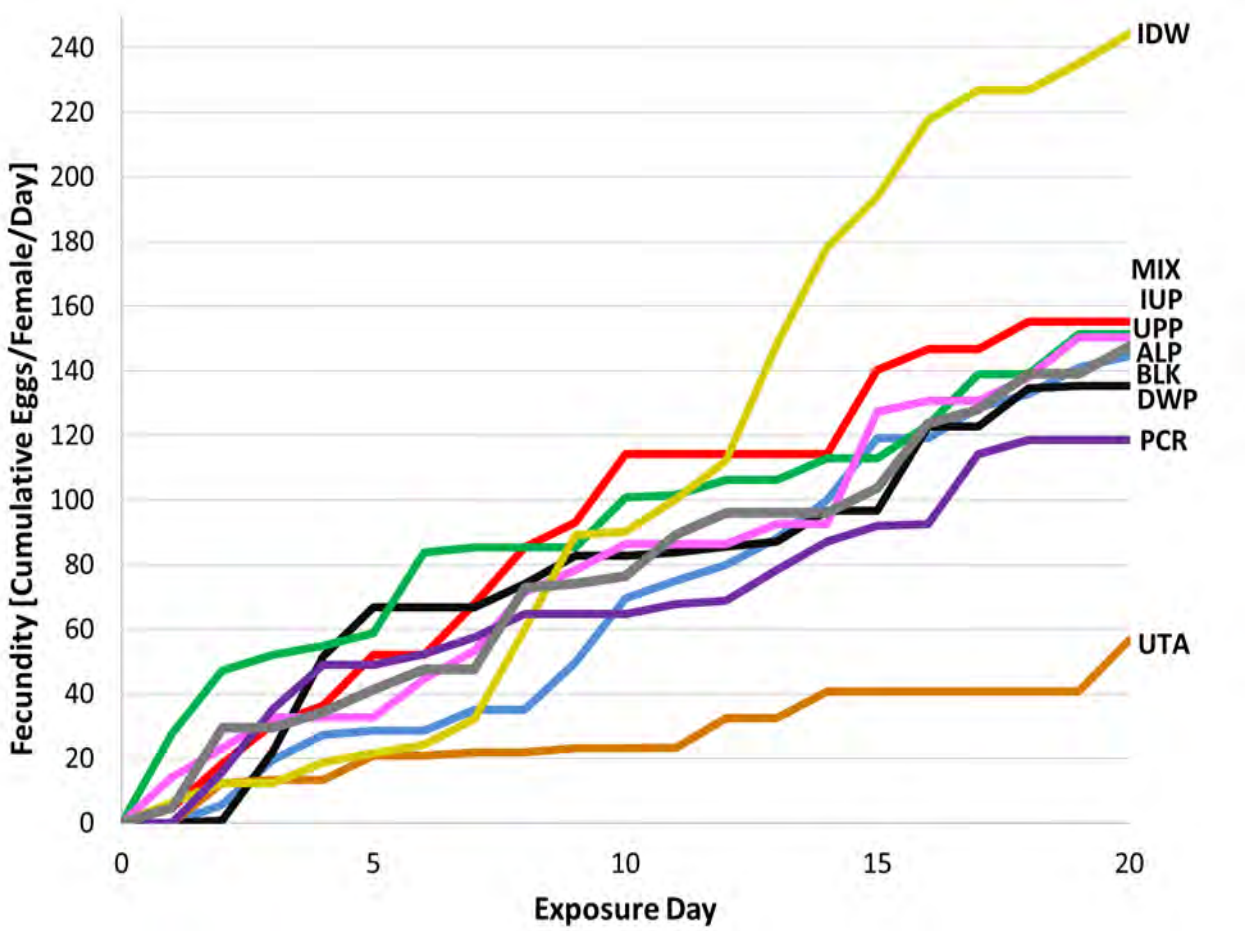
Ubiquitous contaminations with CECs at Two Rivers & Grand Rapids in 2019





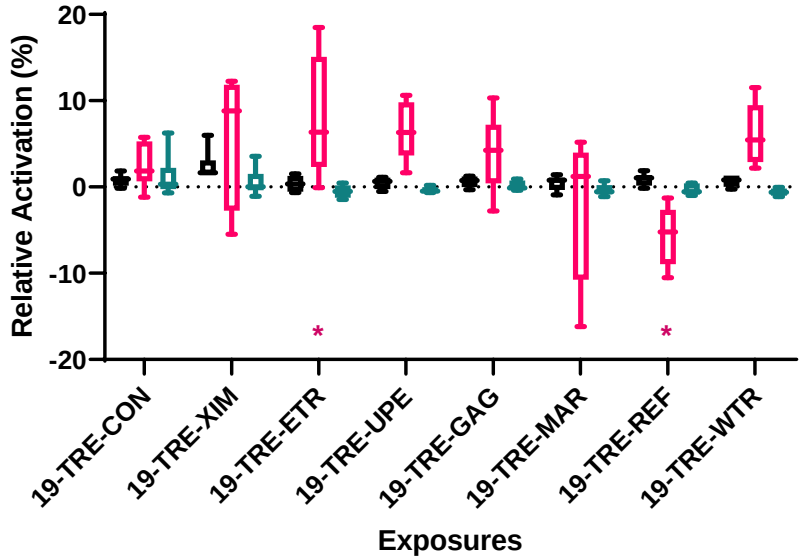
Altered fecundity of fathead minnow in MELT exposure at Two Rivers & Grand Rapids in 2019





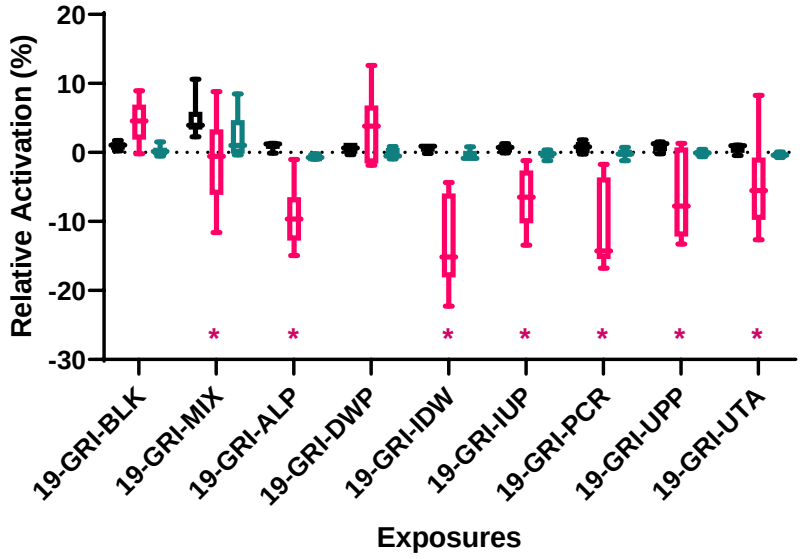
In vitro estrogenicity of MELT water via 3 species Esr1

TWO RIVERS 2019



Source of Variation	% of total variation	P value
Interaction	25.51	<0.0001
Exposures	13.42	0.0002
Species	9.970	<0.0001

GRAND RAPID 2019



Source of Variation	% of total variation	P value
Interaction	24.06	<0.0001
Exposures	17.33	<0.0001
Species	24.20	<0.0001

Acknowledgements

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